

**BEFORE
THE PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA**

DOCKET NO. 2018-319-E

In the Matter of:)	
)	DIRECT TESTIMONY OF
Application of Duke Energy Carolinas, LLC)	JAY W. OLIVER
For Adjustments in Electric Rate Schedules)	FOR
and Tariffs)	DUKE ENERGY CAROLINAS, LLC
)	

1 **Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

2 A. My name is Jay W. Oliver. My business address is 400 South Tryon Street,
3 Charlotte, North Carolina.

4 **Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

5 A. I am employed by Duke Energy Business Services, LLC (“DEBS”) as General
6 Manager, Grid Solutions Engineering and Technology. DEBS provides
7 various administrative and other services to Duke Energy Carolinas, LLC
8 (“DE Carolinas” or the “Company”) and other affiliated companies of Duke
9 Energy Corporation (“Duke Energy”).

10 **Q. PLEASE BRIEFLY DESCRIBE YOUR DUTIES AS GENERAL**
11 **MANAGER, GRID SOLUTIONS ENGINEERING AND TECHNOLOGY**
12 **FOR DUKE ENERGY.**

13 A. My duties and responsibilities include planning for the grid and related system
14 modernization efforts across Duke Energy.

15 **Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND**
16 **PROFESSIONAL QUALIFICATIONS.**

17 A. I have a Bachelor of Science degree in Electrical Engineering from the
18 Georgia Institute of Technology and a Master’s degree in Business
19 Administration from the University of South Florida. I am a licensed
20 Electrical Engineer and a registered Professional Engineer in Florida. From
21 25 years working in the electric utility business, I have experience in electric
22 transmission, distribution, and Information Technology and
23 Telecommunications systems that support utility transmission and distribution

1 networks. I began working at Duke Energy in 1996, joining one of its
2 predecessor companies, Florida Progress. Over the past 10 years, I have held
3 the positions of Region General Manager, Director Distribution Services,
4 Major Projects Manager, and Director, Grid Automation. I have been in my
5 current role since January 2017.

6 **Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THIS COMMISSION**
7 **OR ANY OTHER REGULATORY BODIES?**

8 A. Yes. I testified before the North Carolina Utilities Commission (“NCUC”) in
9 Duke Energy Progress, LLC’s (“DE Progress”) 2013 Demand Side
10 Management/Energy Efficiency proceeding in Docket No. E-2, Sub 1030 and
11 in DE Progress’s 2014 Fuel Charge Adjustment proceeding in Docket No. E-
12 2, Sub 1045.

13 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

14 A. I am testifying as an expert witness in this case in two separate capacities. In
15 my capacity as the witness supporting ongoing operations, I describe and
16 support the existing DE Carolinas’ transmission and distribution (“T&D”)
17 system, the operation and performance of the T&D system, and the costs
18 necessary to operate and maintain it. In my capacity as the witness supporting
19 DE Carolinas’ Grid Improvement Plan for South Carolina, I describe trends
20 affecting the electric grid and how we plan to address those growing
21 challenges through our Grid Improvement Plan.

22 **Q. HOW IS YOUR TESTIMONY ORGANIZED?**

23 A. Following the introduction above, my testimony is organized as follows:

1 I. First, I will provide a description of DE Carolinas' T&D system,
2 describing notable investments made in our system since the
3 Company's last rate case in South Carolina and an overview of the
4 operational performance of the Company's T&D system;

5 II. Second, I will describe the trends affecting the electric grid in the 21st
6 century environment, how we analyze those issues, and how they will
7 impact our grid if addressed through traditional means alone;

8 III. Third, I will describe the tools available to address the trends, explain
9 how programs in the Grid Improvement Plan are evaluated, and
10 present our overarching Plan which addresses the issues in a
11 stakeholder-informed manner;

12 IV. And finally, I will provide a three-year work plan for our grid
13 improvements with defined projects for Commission approval and the
14 grid improvement work to date, which is included in this case. I note
15 we are also requesting a corresponding rate recovery plan in this case
16 as further explained by Witnesses Ghartey-Tagoe, Smith, and Pirro.

17 **Q. ARE YOU PROVIDING ANY EXHIBITS WITH YOUR TESTIMONY?**

18 A. Yes, I have attached 12 total exhibits, described below:

19 Exhibit 1: Maintain Base Transmission and Distribution System Work-
20 describing what work the Company does as base-level maintenance work;

21 Exhibit 2: Megatrends Impacting South Carolina- detailing key trends relevant
22 to the Grid Improvement Program;

1 Exhibit 3: South Carolina Grid Improvement Plan Implications-discussing
2 how megatrends are impacting operations in South Carolina;
3 Exhibit 4: South Carolina Grid Improvement Plan Program Summaries-
4 describing the projects and programs in the Grid Improvement Plan;
5 Exhibit 5: Portfolio Prioritization Methodology-detailing how the Grid
6 Improvement Plan is prioritized;
7 Exhibit 6: Cost/Benefit and Cost Effectiveness Evaluation Execution
8 Protocol-showing how the Company evaluates potential grid improvement
9 projects;
10 Exhibit 7: South Carolina Cost Benefit Analysis-Program Level-providing
11 examples of program-level cost/benefit analyses;
12 Exhibit 8: South Carolina Cost Benefit Analysis-Project Level-providing
13 examples of project-level cost/benefit analyses;
14 Exhibit 9: South Carolina Grid Improvement Plan-detailing the work
15 contained in the Grid Improvement Plan;
16 Exhibit 10: September 6, 2018 South Carolina Grid Improvement Plan
17 Workshop Report-containing the results of the Company's first South Carolina
18 stakeholder workshop;
19 Exhibit 11: October 10, 2018 South Carolina Grid Improvement Plan
20 Workshop Pre-Read-containing materials provided to stakeholders prior to the
21 October 10, 2018 workshop;

1 Exhibit 12: October 10, 2018 South Carolina Grid Improvement Plan
2 Workshop Report-containing the results of the Company's second South
3 Carolina stakeholder workshop;

4 **Q. DO THESE EXHIBITS CONTAIN ONLY INFORMATION ABOUT DE**
5 **CAROLINAS?**

6 A. No. Duke Energy has created a plan for the grid in South Carolina, and that
7 includes both DE Progress and DE Carolinas. All information is shown in a
8 utility specific manner. I believe it's important to show these plans jointly as
9 we think of the needs of customers in the State. Moreover, I believe it
10 facilitates better discussions among parties and entities who have interest in
11 both service territories to see the material presented together.

12 **Q. PLEASE PROVIDE AN OVERVIEW OF YOUR OPERATIONAL**
13 **TESTIMONY.**

14 A. DE Carolinas reliably serves approximately 590,000 customers in South
15 Carolina through a multi-state electric system that includes 13,100 miles of
16 transmission lines, more than 100,000 miles of distribution lines, and more
17 than 1,600 substations. For the DE Carolinas distribution system,
18 approximately 2,970 distribution line miles and 23,700 transformers were
19 added over the last five years.

20 As part of the Company's commitment to reliably serve customers and
21 continually improve operations, DE Carolinas has invested \$3.5 billion in
22 electric plant in service for T&D infrastructure over the last five years.
23 Maintenance work and reliability improvements included replacement of

1 deteriorated wooden poles, replacement of obsolete line and substation
2 equipment, and customer-driven line and substation expansions.

3 DE Carolinas also maintains a comprehensive vegetation management
4 program across the state that works to proactively maintain trees both within
5 and without the rights-of-way on regular cycles. This work seeks to improve
6 overall reliability, harden the grid against severe weather, and reduce the
7 impact of vegetation which currently accounts for 20 to 25 percent of outages
8 across the system.

9 Overall, the DE Carolinas grid is reliable and well-maintained. While
10 the Company has worked hard to maintain the system well and reliably meet
11 the needs of customers, we also increasingly understand more must be done to
12 improve the state's energy infrastructure to meet the energy challenges and
13 opportunities that lie ahead.

14 **Q. PLEASE PROVIDE A SUMMARY OF THE COMPANY'S GRID**
15 **IMPROVEMENT PLAN.**

16 A. Through a comprehensive assessment of the state of the grid and influences
17 affecting the region, the Company has identified several emerging trends,
18 which I refer to in my testimony as "megatrends," that drive the need to make
19 improvements now to the electric system in South Carolina.

20 South Carolina is a growing state, especially in urban and suburban
21 areas, where residential and business growth is becoming concentrated. With
22 that growth comes growing consumer expectations for more interaction with
23 their electric company and more control over the way they use electricity.

1 And along with that, a higher reliance on “perfect power” – power that stays
2 on and when an outage does occur, is restored faster than ever.

3 As recent events have reinforced, the Company must be ready for
4 severe weather before it strikes and reduce the impact of storms that are
5 worsening in frequency and intensity. The Company must be vigilant and
6 prepare now for the very real threat of cyber and physical attacks. And as
7 renewable energy and distributed energy technologies like solar energy,
8 battery storage, micro-grids, and electric vehicles become more affordable and
9 accessible, it is important to take steps now to ready the grid to support the
10 growth of these technologies that are important to the state’s energy future.

11 All of these influences come at a time of increasing environmental
12 commitments and compliance requirements that drive change for the
13 Company and the industry. But they also come at a time when grid
14 technology is rapidly advancing and becoming increasingly intelligent,
15 providing new tools and new opportunities to improve the way the Company
16 serves customers.

17 To deliver on customer expectations and address these trends, the
18 Company believes that we must do more than maintain the power grid; the
19 Company must make the appropriate investments to transform it, making
20 strategic, data-driven improvements to power a smart-thinking grid that is
21 more reliable, more resilient, and built to meet the energy needs of customers
22 today and into the future.

1 Duke Energy Carolinas' SC grid improvement plan was developed
2 through a comprehensive analysis of the trends affecting our business in the
3 state and the tools to best address those trends in a cost-effective and timely
4 manner. The grid improvement plan is built upon strategic, data-driven
5 investments to improve reliability to avoid outages and speed restoration;
6 harden the grid to protect against cyber and physical threats; expand solar and
7 other innovative technologies across a two-way, smart-thinking grid; and give
8 customers more options and control over their energy use and tools to save
9 money. These improvements will provide benefits now and in the years to
10 come.

11 Components of Duke Energy's grid improvement plan operationally
12 fall into one of three categories:

- 13 • Compliance-driven programs that protect the grid;
- 14 • Programs that leverage advanced technologies to modernize the grid; and
- 15 • Projects and programs that work to optimize the customer's experience.

16 **1. Protect the grid**

17 More must be done to strengthen the grid and mitigate the impact of
18 major storm events, as well as to harden and defend the grid against critical
19 physical and cybersecurity risks. Compliance requirements in these areas are
20 also driving improvements across the state. Examples of the company's multi-
21 layered improvements designed to protect the grid include:

- 22 • Installing protective devices to limit access to critical systems and
23 minimize outages from physical or cyber attack; and

- Relocating, raising, or reinforcing equipment in flood-prone areas.

2. Modernize the grid

Technology is rapidly changing, and more must be done to incorporate and anticipate new technologies to better serve a growing state. Customers – more than ever – expect more options, greater reliability, and value. Self-selecting billing and payment dates, scheduling appointments, accessing real-time usage data, and information updates when outages occur are all examples of basic services consumers expect but require technology to deliver. And increasingly, consumers want access to information about how they use energy and tools to take control of that energy use and save money.

Examples of improvements designed to modernize the grid include:

- Smart meters to provide improved customer usage data, enhanced outage detection to improve customer service, and access to increased customer options to manage energy use and save money.
- Distribution automation and dispatch tools to improve power quality and reliability and support the growth of distributed energy resources and customer-owned technologies.
- Integrated system operations planning, automation, and system intelligence to prepare the grid for increased distributed resources and the dynamic power flows that these technologies bring.

3. Optimize the customer experience

Customers want and deserve a better experience, built on the technology needed to meet their changing energy needs. To meet these

1 expectations, we must optimize the total customer experience and transform
2 the grid to prepare it for the energy opportunities that lie ahead.

3 Optimization upgrades in the grid improvement plan include:

- 4 • A self-optimizing, smart-thinking grid that anticipates outages and
5 automatically reroutes service to keep power on for customers. Self-
6 optimizing technology can reduce outage impacts on customers by as
7 much as 75 percent. It will also provide the foundation for the two-way
8 power flows needed to support more rooftop solar, battery storage, electric
9 vehicles, and microgrids – technologies that will increasingly power the
10 lives of customers.
- 11 • Expanded energy storage capabilities and infrastructure, which will help to
12 power self-optimizing technologies in areas where building a redundant
13 power line may not be feasible.
- 14 • Electric vehicle charging infrastructure improvements to expand
15 transportation options for customers across the state.
- 16 • Voltage optimization and distribution of power to customers to improve
17 reliability, increase system intelligence and support the two-way power
18 flow needed to grow distributed resources.
- 19 • Upgrading utility poles, transformers, and other grid equipment, as well as
20 using advanced data to strategically underground the most vulnerable,
21 outage-prone lines on the distribution system.

22 The Company has constructed the Grid Improvement Plan, with
23 stakeholder feedback, to address the risks and opportunities that the analysis

1 revealed. The Plan seeks to balance the pace, scope, location, and timing of
2 our work to address a diverse set of customer and stakeholder needs. As we
3 built the Grid Improvement Plan proposed in this case, the Company has also
4 kept the needs of our rural and low-income customers in mind and sought to
5 develop a strategy that maximizes benefits to customers and the state, while
6 keeping costs as low as possible.

7 In developing this informed plan, the Company layered our data
8 analytics with significant input from customers, customer and advocacy
9 groups, and other stakeholders. Finding common ground on important topics
10 that affect all of our customers is very important to Duke Energy. The
11 Company realizes that plans that look good on paper may not translate the
12 way we think they will when executed in the real world. That is why the
13 Company has sought out customer and stakeholder perspectives, including
14 multiple stakeholder workshops, as part of the process before presenting this
15 grid improvement plan.

16 I am presenting a three-year South Carolina Grid Improvement Plan
17 that I believe can effectively serve customers now and in the years ahead. The
18 Company's application requests that the Commission approve our Grid
19 Improvement Plan as detailed in Exhibit 9. Exhibit 9 shows numbers for
20 South Carolina based on budgeting methods, which may vary from
21 ratemaking allocations. The details regarding the Company's proposal to
22 recover the costs related to the Grid Improvement Plan are included in
23 Witness Smith's testimony. The proposed system investment of \$336 million

1 and \$534 million respectively for 2019 and 2020 can be seen on Smith Exhibit
2 3 Page 6, and the South Carolina Retail allocated portion for rate making of
3 the proposed system spend is \$68 million and \$111 million, which is also on
4 Smith Exhibit 3 Page 6.

5 The Grid Improvement Plan is about making smart choices now to
6 make the state's energy grid more reliable, more secure, and ready for the
7 energy opportunities that lie ahead. Just as the past decade modernized the
8 way Duke Energy generates electricity, the years ahead will transform the way
9 we deliver electricity and serve customers. With each improvement, we can
10 improve the overall reliability of the grid and enhance service for every
11 customer, regardless of the type of customer and where they are located.

12 **I.DE CAROLINAS' T&D SYSTEM OVERVIEW AND INVESTMENTS**
13 **SINCE THE COMPANY'S LAST RATE CASE IN SOUTH CAROLINA**

14 **Q. PLEASE GENERALLY DESCRIBE DE CAROLINAS' T&D SYSTEM**
15 **IN THE CAROLINAS.**

16 A. DE Carolinas' T&D system delivers electric service to approximately 2.6
17 million retail customers located throughout a 24,000-square mile service area
18 in central and western North Carolina and western South Carolina.
19 Approximately 590,000 of the Company's retail customers are in South
20 Carolina. In addition to its retail customers, DE Carolinas also sells electricity
21 at wholesale rates to municipal, cooperative, and other investor-owned
22 utilities.

23 DE Carolinas operates as a single balancing authority to economically
24 manage the Company's integrated electric delivery systems in both North

1 Carolina and South Carolina, collectively. This system interconnects with
2 nine other balancing authority areas¹ and includes 13,100 circuit miles of
3 transmission lines. The distribution system is comprised of approximately
4 66,600 miles of overhead distribution lines and 37,800 miles of underground
5 distribution lines. DE Carolinas' T&D system also includes 198 transmission
6 substations, and 1,398 distribution and industrial substations with a combined
7 capacity of approximately 98 million KVA. In addition to power lines and
8 substations, the system includes various other equipment and facilities such as
9 control rooms, computers, poles, transformers, regulators, capacitors, street
10 lights, meters, and protective relays. Together, these assets provide the
11 Company considerable operational flexibility with its T&D system and allow
12 DE Carolinas to provide safe, reliable, and economical power to the
13 Company's customers in South Carolina.

14 **Q. HAS DE CAROLINAS' T&D SYSTEM GROWN SINCE THE LAST**
15 **RATE CASE?**

16 A. Yes. The T&D system has expanded over time to ensure adequate system
17 voltage and capacity, based on projected system loading, and contingency
18 requirements related to providing safe and reliable service to our customers.
19 Transmission system growth has also occurred because of new generation
20 and/or decommissioning of existing generation assets. For the DE Carolinas
21 distribution system, approximately 2,970 distribution line miles and 23,700

¹ The PJM Regional Transmission Organization, Carolina Power and Light – East, Carolina Power and Light – West, Southern Company, Santee Cooper, Tennessee Valley Authority, Cube Hydro Carolinas, SC Electric & Gas and Southeastern Power Authority.

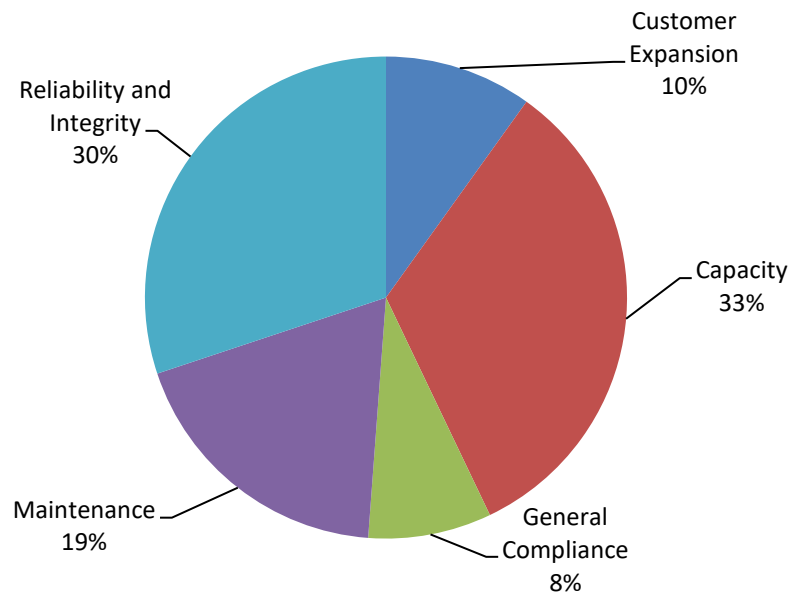
1 transformers were added over the last five years. Overall, we have added
2 approximately \$3.5 billion to electric plant in service for T&D infrastructure
3 in the last five years.

4 **Q. CAN YOU PROVIDE MORE DETAIL ABOUT THE ADDITIONAL**
5 **INVESTMENTS THE COMPANY HAS MADE IN ITS T&D SYSTEM**
6 **SINCE THE LAST RATE CASE?**

7 A. Additional investments in the Company's T&D system have been made to
8 provide capacity to serve system growth, ensure adequate system voltage,
9 support transmission-related infrastructure for both new generation and
10 decommissioning of generation, and improve certain aspects of system
11 reliability. Over the past five years, more than \$1 billion was invested in the
12 transmission system and approximately \$2.5 billion in the distribution system.

13 The chart below illustrates the major categories of the transmission
14 system capital investment over the last five years.

Transmission Base Capital Expenditures

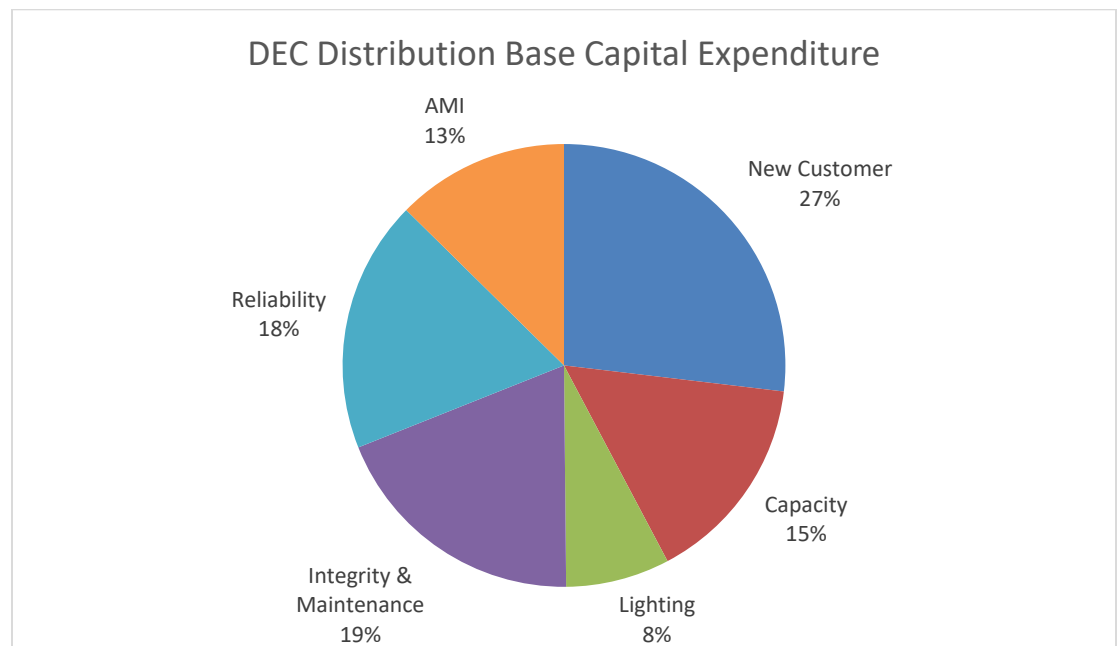


1 In the transmission system, approximately 33 percent of investment was
2 driven by capacity requirements to serve load and to meet the North American
3 Reliability Council ("NERC") Planning Standards and generation driven
4 projects such as the Riverbend decommissioning and the addition of the Lee
5 Combined Cycle Plant. Approximately 30 percent of investment was driven
6 by standard reliability improvement programs. Approximately 19 percent of
7 investment was driven by maintenance programs, including the replacement
8 of deteriorated wood poles and replacement of obsolete substation and line
9 equipment. Approximately 10 percent of the investment was driven by
10 customer expansion work which includes new customer projects as well as
11 line and substation upgrades driven by transmission service requests.
12 Approximately 8 percent of the investment was driven by compliance projects
13 including the ever-evolving cyber security and physical security programs

1 driven by requirements defined in NERC CIP Standards CIP-002-5.1 and
2 CIP-014-2. One particularly large project, referred to as the Carolinas West
3 Primary Control Center (“CWPDCC”), was placed in-service in September
4 2017 and has a value of approximately \$130 million.

5 The CWPDCC is part of an enterprise program whereby Duke Energy
6 is updating and consolidating multiple regional centers into purpose-built,
7 highly reliable and hardened facilities. The facility supports increased North
8 American Electric Reliability Corporation (“NERC”) reliability standard
9 requirements for Critical Infrastructure Protection and Emergency Operations
10 Preparedness. Maintaining the integrity of the electric grid is at the core of the
11 Company's responsibilities and these new facilities will allow DE Carolinas to
12 provide dependable and consistent service for many years into the future.

13 The chart below illustrates the major categories of the distribution
14 system and the capital expenditures over the last five years.



1 South Carolina continues to be a desirable place to live and work, as
2 evidenced by the more than 10,000 new retail customer meters added during
3 the 12-month period ending December 31, 2017. Typically, new customers
4 locate in areas where DE Carolinas must build new distribution facilities to
5 serve them, including expenses for new customer connections or capacity
6 work needed to support overall load growth. Approximately 50 percent of the
7 Company's distribution expenditures over the last five years are for load
8 expansion-related work, including serving new customers, lighting
9 installations, and additional capacity.

10 Approximately 37 percent of the remaining investments on the
11 Company's system relate to base-level work around standard reliability and
12 integrity programs that address safety and environmental requirements and
13 maintenance including service restoration. Approximately 13 percent was for
14 the deployment of AMI.

15 **Q. CAN YOU PROVIDE DETAIL ABOUT HOW THE COMPANY**
16 **DETERMINES WHAT IS TO BE CATEGORIZED AS BASE T&D**
17 **SPENDING?**

18 A. Yes. The type and scope of transmission and distribution "Maintain Base"
19 work that we perform on our system can generally be thought about as a
20 product of the following equation: [Safety Requirements] + [Load Service
21 Requirements] + [Reliability Requirements] + [Environmental Requirements]
22 = Type and Scope of Work. What work goes into the four elements of this
23 equation may be dictated by mandatory external requirements (such as laws,

1 codes, and regulations), internal company standards, national industry
2 standards, or a combination of these requirements and standards, but any base-
3 level work done on the transmission and distribution system fits into one of
4 these four categories. In Exhibit 1 to my testimony, I have provided more
5 detail as to what general work fits into each one of the categories.

6 **Q. IN YOUR OPINION, ARE ALL THE T&D FACILITIES INCLUDED IN**
7 **DE CAROLINAS' BASE RATE REQUEST USED AND USEFUL IN**
8 **PROVIDING SERVICE TO DE CAROLINAS' RETAIL ELECTRIC**
9 **CUSTOMERS IN SOUTH CAROLINA?**

10 A. Yes. Including the projects that will be completed prior to the evidentiary
11 hearing in this case, all of the reasonable and prudent additions to DE
12 Carolinas' T&D system requested for recovery in base rates are used and
13 useful to its approximately 590,000 customers in South Carolina.

14 **Q. HAVE THE T&D INVESTMENTS THAT THE COMPANY HAS MADE**
15 **ALLOWED IT TO MEET ITS OPERATIONAL PERFORMANCE AND**
16 **CUSTOMER SATISFACTION GOALS?**

17 A. Yes, they have, but as I discuss later in my testimony, we are seeing
18 unfavorable trends that are making these goals more challenging to meet. DE
19 Carolinas' principal goal is to deliver safe and reliable electric service at
20 reasonable prices. We measure this principal goal based on customer
21 satisfaction, safety, and reliability of the Company's T&D systems, while
22 responsibly managing operational and capital expenditures for the benefit of
23 our customers.

1 **Q. PLEASE EXPLAIN THE METRICS THE COMPANY USES TO**
2 **MEASURE THE EFFECTIVENESS OF ITS T&D OPERATIONS.**

3 A. DE Carolinas utilizes several industry-standard metrics to assess the overall
4 effectiveness of its T&D operations. These metrics include reliability indices
5 to measure the performance of the transmission and distribution system and
6 customer satisfaction scores to determine how well the Company is meeting
7 the needs of its customers.

8 The Company uses several industry-accepted transmission and
9 distribution performance metrics as defined in IEEE Standard 1366-2012:

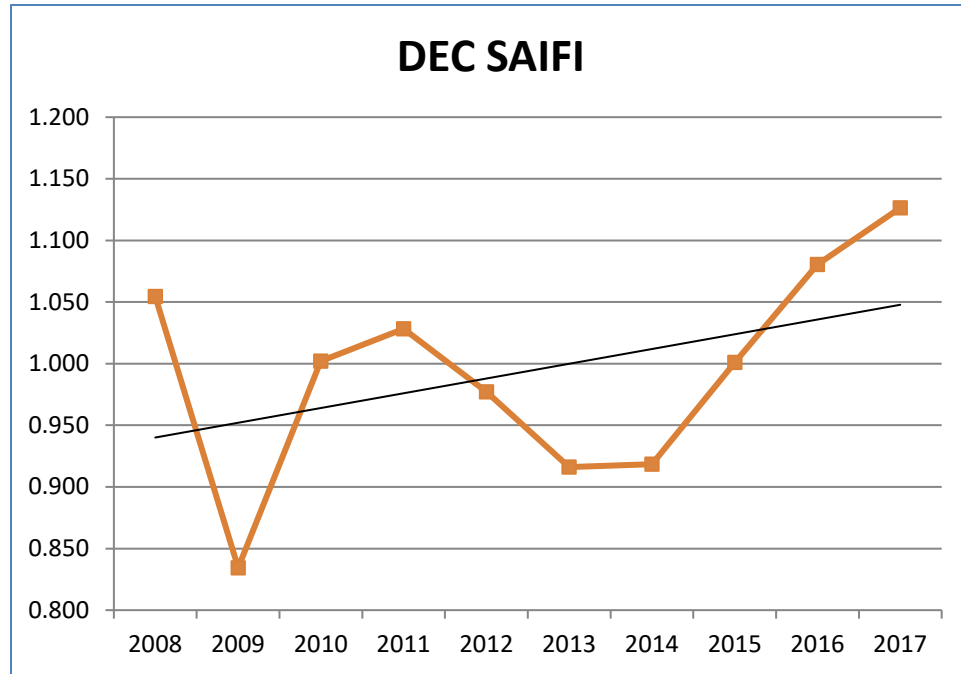
- 10 • **System Average Interruption Frequency Index (“SAIFI”)** is a ratio that
11 indicates how often the average customer experiences a sustained
12 interruption over a predefined period of time.
- 13 • **System Average Interruption Duration Index (“SAIDI”)** is a ratio that
14 indicates the total duration of interruption for the average customer during
15 a predefined period of time.
- 16 • **Customers Experiencing Multiple Interruptions (“CEMI 6”)** is a
17 measure of the percentage of customers who experience six or more
18 outages in a 12-month period.

19 **Q. HOW HAS DE CAROLINAS’ TRANSMISSION AND DISTRIBUTION**
20 **SYSTEM PERFORMED UNDER THESE METRICS?**

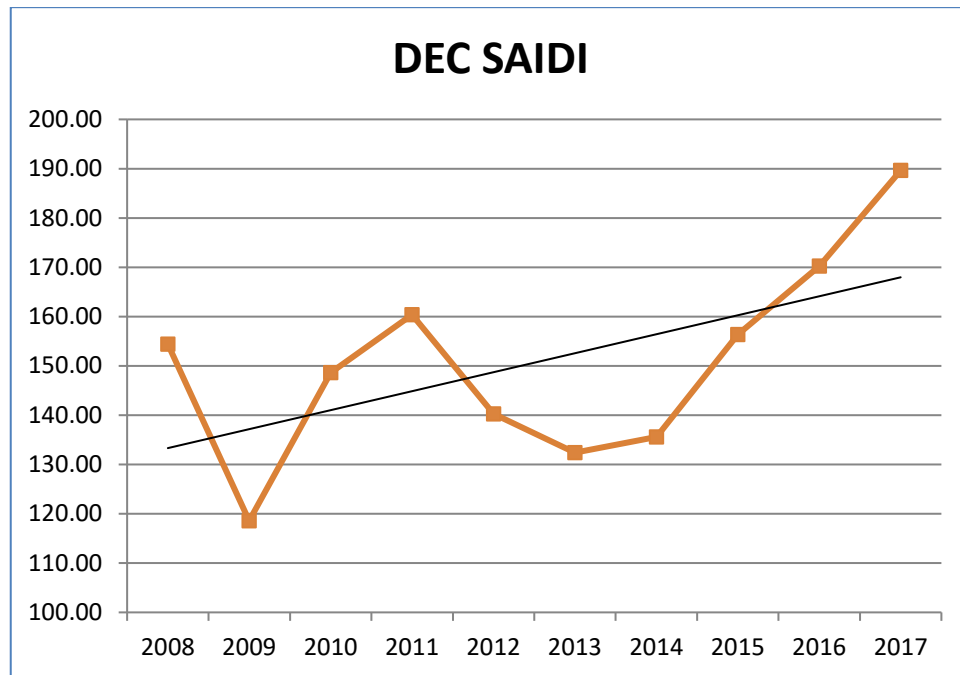
21 A. Our system has performed well, and we have continued to provide safe,
22 reliable, and affordable electric service to our customers. Over the past ten
23 years, however, both SAIFI and SAIDI show an unfavorable trend, with the

1 frequency and duration of outages increasing across the DE Carolinas system
2 despite our efforts and investments that I have discussed previously. Graphs
3 displaying the trends for these metrics are set forth below:

**Figure 1 – Duke Energy Carolinas’ Historic System Average
Interruption Frequency Index (SAIFI)**



**Figure 2 – Duke Energy Carolinas’ Historic System Average
Interruption Duration Index (SAIDI)**



1 In summary, reliability performance is worsening due to the increase
2 in the number of outage events. There are several factors and trends, which I
3 address later in my testimony, contributing to the worsening reliability trends.

4 **Q. PLEASE EXPLAIN THE COMPANY’S APPROACH TO**
5 **DISTRIBUTION VEGETATION MANAGEMNT AND DESCRIBE ANY**
6 **CHANGES THE COMPANY HAS MADE TO ITS APPROACH SINCE**
7 **THE LAST RATE CASE.**

8 A. Vegetation management is a critical component of the Company’s power
9 delivery operations and the continued effort to drive performance for
10 customers’ benefit. DE Carolinas uses a reliability-based prioritization model
11 to drive its routine integrated vegetation management program. In addition to

1 routine circuit maintenance, there are four other important components to the
2 Company's overall vegetation management approach.

3 (1) Herbicide Program – The purpose of the Annual Herbicide Program is
4 to control re-growth of incompatible vegetation within the right-of-
5 way “floor” in non-landscaped areas;

6 (2) Hazard Tree Program – This program is designed to identify/remove
7 dead, dying, and diseased trees primarily located outside of the
8 existing Distribution right-of-way;

9 (3) Reactive Program – This program is designed to address customer
10 initiated requests as well as vegetation related power quality issues
11 identified as part of outage follow-up investigations; and

12 (4) Disciplined vegetation management outage follow-up process tied to a
13 formal internal reliability review process.

14 In 2013, Duke Energy completed a tree growth study which
15 established an optimal tree-trimming cycle with targeted trim dates by
16 classification including old-urban 5-year cycle, mountain 7-year cycle, and
17 other 9-year cycle, otherwise referred to by the Company as the 5.7.9 Plan.
18 An enhanced program based on the tree growth study and a reliability tree
19 trimming model was implemented to produce a cost-effective reliability
20 performance plan for outages caused by vegetation.

21 **Q. PLEASE MORE FULLY DESCRIBE THE 5.7.9 PLAN AND HOW DE**
22 **CAROLINAS HAS IMPLEMENTED THIS PLAN.**

23 **A.** The 5.7.9 plan is defined as follows:

- 1 • There are 2,180 old urban miles to be trimmed on the 5-year cycle.
- 2 “Old Urban Circuits” are designated by Duke Energy as the overhead
- 3 lines in older, high density neighborhoods or historic districts that
- 4 consist of mature and/or over-mature, streetscape, and landscape trees.
- 5 The line construction is typically in the public right-of-way along the
- 6 street and rear, or in side lots along the property line between the
- 7 neighborhood homes. Many trees on the Old Urban Circuits are
- 8 directly under the line and are in direct conflict with the overhead
- 9 distribution system. Thus, these trees will never be allowed to obtain
- 10 normal form or development and have traditionally required height
- 11 reduction pruning. Due to the reliability characteristics and clearance
- 12 needed at the time of pruning, we target these circuits to be on a 5-year
- 13 pruning schedule. The desired timeframe is driven by the growth
- 14 characteristics of the trees and associated target clearance needs, as
- 15 well as system reliability.
- 16 • There are 7,831 mountain miles to be trimmed on the 7-year cycle.
- 17 “Mountain” circuits are characterized by a high percentage of the line
- 18 miles being impacted by vegetation, lesser customer densities, and
- 19 difficult terrain, as well as many of the lines being non-accessible to
- 20 mechanized equipment.
- 21 • There are 41,603 other miles to be trimmed on the 9-year cycle.
- 22 “Other” circuits are targeted for a 9-year average trim cycle and
- 23 include all circuits that are not classified as Old Urban or Mountain.

1 As part of our prioritization process, as circuits become close to the
2 targeted 5.7.9 trim cycle, heavier weight is placed on last trim dates within the
3 prioritization process. The Company is in the process of ramping up to the
4 targeted tree trimming cycles in the 5.7.9 trim cycles with targeted full
5 implementation in 2019.

6 **Q. DOES THE COMPANY PROPOSE AN INCREASE IN FUNDING FOR**
7 **VEGETATION MANAGEMENT?**

8 A. Yes. As explained by Witness Smith, we have included a pro forma
9 adjustment of \$6 million for the South Carolina retail portion of the
10 incremental O&M expense associated with these beneficial improvements.
11 The increase will cover spending the necessary amount on an annual basis to
12 trim its annual target distribution miles under its 5.7.9 plan as described
13 above. Additionally, increases are needed for the contract rate increases that
14 took effect in 2017 and 2018 of 7 percent and 18 percent, respectively. These
15 increases are driven by a tightening labor market and increasing safety
16 standards, so we expect cost for vegetation management to further increase in
17 the coming years.

18 **Q. WILL THE COMPANY'S 5.7.9 VEGETATION MANAGEMENT PLAN**
19 **CURE ALL ADVERSE SYSTEM IMPACTS THAT THE COMPANY**
20 **HAS SEEN DEVELOP IN THE RECENT PAST?**

21 A. No. Vegetation events account for 20 to 25 percent of all outage events. It is
22 important to understand that approximately 75 to 80 percent of all outages on
23 the grid are due to other causes, such as equipment failure, public accidents,

1 and environmental factors. In addition, for the 20 to 25 percent of events that
2 are vegetation related, only 50 percent of these are related to vegetation inside
3 the right-of-way where the Company can perform vegetation management.
4 The other 50 percent occur due to trees outside the right-of-way that will fall
5 into or otherwise impact distribution lines, and the Company does not have
6 the ability to perform vegetation management on these trees that are located
7 on private property. For the outages that occur because of trees inside the
8 right-of-way, even a perfectly executed integrated vegetation management
9 plan will not bring this number down to zero but instead will only help
10 minimize vegetation outages.

11 Keeping these facts in mind, the Company engaged in the Tree Growth
12 Study that I previously discussed to determine the optimal right-of-way
13 trimming cycles for our geographical areas. Trimming more often than these
14 now pre-determined, optimal cycles will only provide diminishing returns and
15 would not be cost effective. Drastic clear cutting and going onto customer
16 property and cutting down live trees via condemnation or negotiating with
17 customers for rights on their property is also impractical and not cost
18 effective. Instead, programs such as targeted undergrounding, which will be
19 discussed in more detail later in my testimony, can be effectively used to
20 address vegetation outages caused by trees outside of the right-of-way, where
21 the base vegetation plan stops.

**II. NEW TRENDS AFFECTING THE SOUTH CAROLINA
ELECTRIC GRID**

**Q. HAVING DESCRIBED THE EXISTING T&D SYSTEM AND HOW
THE COMPANY MAINTAINS ITS BASE-LEVEL OF SYSTEM
PERFORMANCE, WOULD YOU PLEASE PROVIDE DETAIL ON
THE SOUTH CAROLINA GRID IMPROVEMENT PLAN?**

A. Yes. There are seven major trends that we call “Megatrends” impacting Duke
Energy’s grid in South Carolina. The trends are summarized below and are
discussed individually in detail in Exhibit 2:

1. Population and business growth continues in South Carolina and is
heavily concentrated in urban and suburban areas;
2. Technology is advancing at a rapid rate in the areas of renewables and
distributed energy resources (DERs), which means there are new types
of load and resources impacting the grid;
3. Technology is also advancing rapidly within the devices and systems
that operate and manage the T&D grids, offering new capabilities and
requiring new functionalities;
4. Customer expectations and use of the grid are very different from
generations past;
5. There has been an increase in environmental commitments from the
international to local level in DE Carolinas’ service territory;
6. The number, severity and impact of weather events on DE Carolinas’
customers has been increasing significantly; and

1 7. The threat of physical and cyber attacks on grid infrastructure is more
2 sophisticated and is on the rise.

3 These seven Megatrends are the factors that are driving the need for the
4 Company to have a Grid Improvement Plan that goes beyond the work that
5 the Company performs to maintain base-level operations.

6 **Q. HOW DID THE COMPANY IDENTIFY AND VALIDATE THAT**
7 **THESE MEGATRENDS EXIST?**

8 A. Over the past several years, we have seen these Megatrends develop in the
9 day-to-day operation of our business. Some of these Megatrends, such as the
10 increased number and increased sophistication of attempted cyber attacks on
11 our system, are easily identified and are evident as they happen. Other
12 changes, such as the way our customers are using and depending on the power
13 we provide them, are more subtle and can be harder to identify. With all these
14 Megatrends, however, our first step was to inventory facts and information
15 that we saw from operating our grid that appeared different than the facts and
16 information we had seen in the previous years of operation.

17 Once we had conducted the aforementioned inventory, we then looked
18 across the industry to see if other utilities and industry stakeholders were
19 seeing the same Megatrends developing in their operations. As we suspected,
20 the same new Megatrends that we are seeing develop in South Carolina are
21 also being seen throughout the industry.

1 **Q. HOW DID THE COMPANY GO ABOUT ESTABLISHING THAT THE**
2 **FACTS AND INFORMATION IT WAS SEEING ROSE TO THE LEVEL**
3 **OF ESTABLISHING WHAT YOU HAVE CALLED MEGATRENDS?**

4 A. During this process of identifying and validating the Megatrends, we collected
5 objective information from our own operations in South Carolina as well as
6 from our companies that function in other jurisdictions. From South Carolina
7 to Florida, and in Kentucky, Ohio, Indiana, and North Carolina, we began to
8 see commonality in the facts and information that evidenced the existence of
9 these Megatrends. From there, we then began to look at objective national
10 information that non-Duke companies and industry stakeholders were sharing
11 publicly. That information also confirmed the existence and validity of the
12 megatrends. In Exhibit 2 to my testimony, I have included summary data,
13 citations, and information that the Company collected on each Megatrend.
14 The 2016 South Carolina State Energy Plan also noted the existence of many
15 of these trends, as the following passage reveals:

16 “In developing this State Energy Plan, it has become very evident that
17 electric utilities are facing expanding customer expectations,
18 increasing environmental regulation, and new technologies that have
19 to be integrated seamlessly into the grid. The grid of the rapidly
20 approaching future will function in ways never imagined when the
21 original wires were installed. If South Carolina is to participate in the
22 innovation coming to fruition in the electric sector — such as
23 distributed energy resources like solar panels, wind turbines, electric

1 vehicles, and microgrids — then the state will require an advanced,
2 integrated grid to manage and optimize the increasingly dynamic flow
3 of electricity.”²

4 **Q. WHAT WAS THE NEXT STEP IN THE DEVELOPMENT OF THE**
5 **GRID IMPROVEMENT PLAN AFTER THE COMPANY IDENTIFIED**
6 **AND VALIDATED THE EXISTENCE OF THE MEGATRENDS?**

7 A. Once we found that the Megatrends we were seeing in South Carolina were
8 valid and that those Megatrends were also impacting utilities across the
9 nation, we then had to analyze whether the Megatrends mattered. Said
10 another way, the Company had to evaluate whether any or all of the
11 Megatrends caused any problems or issues that warranted work in South
12 Carolina that was above and beyond the Company’s base-level T&D plan that
13 I have previously discussed.

14 **Q. DID THE COMPANY PERFORM THIS EVALUATION?**

15 A. Yes, we did. To determine whether one or more of these Megatrends
16 warranted the Company to develop an incremental Grid Improvement Plan for
17 the state, the Company first listed out all the implications that the Megatrends
18 would logically and objectively have on providing our customers safe,
19 reliable, satisfying, and affordable electric service. For example, one of the
20 facts we discovered was that customers with higher usage and higher
21 expectations for power quality and reliability were beginning to concentrate
22 more and more in urban and suburban areas such as Greenville. Given this

² <http://www.energy.sc.gov/files/Energy%20Plan%20Appendices%2003.02.2018.pdf>
2016 South Carolina State Energy Plan, Appendices, Page 121.

1 seemingly undeniable fact, we had to ask the question of what this fact means
2 to our T&D operations. What we found is that capital demands to meet
3 system expansion for these customers using a business as usual approach (i.e.
4 adding capacity) in high growth areas can undermine investment in rural areas
5 of the state causing disparity between customer demographics and geography.
6 In Exhibit 3 to my testimony, I have included our evaluations of these
7 Megatrends and what implications they will have on the Company's grid
8 operations.

9 **III. GRID IMPROVEMENT PLAN**

10 **Q. ONCE THE COMPANY IDENTIFIED AND VALIDATED THE**
11 **MEGATRENDS AND THE IMPACTS THEY ARE HAVING NOW AND**
12 **THAT THEY WILL HAVE ON THE GRID IN THE FUTURE, WHAT**
13 **PROCESS DID THE COMPANY USE TO PUT ALL THIS**
14 **INFORMATION INTO A GRID IMPROVEMENT PLAN?**

15 **A.** At this point in our evaluation, the Company took the following overall steps
16 to develop a proactive plan that addresses impacts of the Megatrends:

- 17 1. Identified "tools" (i.e. utility projects and programs) available to
18 address the Megatrend impacts. In Exhibit 4, I have included detailed
19 descriptions of the programs and projects that the Company considered
20 as "tools" to address Megatrend implications;
- 21 2. Determined constraints that impacted the creation of the plan such as
22 equipment availability, manpower limitations, available time and

- 1 schedule, any applicable prescriptive requirements, interplay with
2 base-level work needs, and price impact;
- 3 3. Selected “tools” to use in the plan in an iterative process that built up
4 from a foundation of protecting the grid first and foremost;
5 establishing foundational, system-level programs that are needed for
6 all aspects of operations and that impact all customers next; and then
7 focusing on projects and programs that help address the most number
8 of Megatrend implications for the best value to customers. We called
9 this phase of the plan development “protect,” “modernize,” and
10 “optimize,” and I have included a series of graphics that help to
11 explain this process as Exhibit 5 to my testimony; and
- 12 4. Developed a final, comprehensive Grid Improvement Plan that
13 efficiently organizes the work to be completed based on where, when,
14 and how much is appropriate.

15 **Q. YOU MENTIONED THAT THE FIRST STEP IN DEVELOPING THE**
16 **GRID IMPROVEMENT PLAN WAS IDENTIFYING TOOLS THE**
17 **COMPANY HAS TO ADDRESS THE MEGATRENDS. CAN YOU**
18 **PROVIDE MORE DETAIL ON THIS PHASE OF THE PLAN**
19 **DEVELOPMENT?**

20 A. Yes. The programs and projects that are available to the Company to help
21 address the implications of the Megatrends in South Carolina can be grouped
22 into three basic categories based on how the Company brings those programs
23 into its plan. These three categories are (1) compliance-driven programs that

1 protect the grid, (2) rapid technology advancement programs that modernize
2 the grid, and (3) various other projects and programs that work independently
3 or together with other programs to optimize our customers' experience. I will
4 further describe those categorizations below.

5 **Q. WHAT CONSTITUTES COMPLIANCE-DRIVEN WORK THAT IS**
6 **DESIGNED TO PROTECT THE GRID?**

7 A. Compliance-driven programs in the Grid Improvement Plan are efforts which
8 need to be completed to reduce physical and cyber threats to the grid. These
9 programs may be necessitated by an external law, rule, or regulation
10 applicable to the company that requires the work; a binding legal obligation
11 such as a contract, agency order, or other legal document that compels the
12 work; or Operations Council approval of the work as being critical and
13 imperative to the Company's operations. To qualify for inclusion in the Grid
14 Improvement Plan, work in this category is limited to rapidly evolving threats
15 to the grid that outpace the scope and timing of standard compliance work
16 done in our base-level operations. The type of work to address these concerns
17 includes applying physical and cyber protections to transmission substations
18 and distribution assets that are not yet covered under mandatory federal
19 regulations such as special protective fencing and barricades to help minimize
20 the threat of gunshot attacks to equipment, intruder sabotage, and vehicle
21 attacks to critical equipment, and installing tamper alarms and protective
22 cyber "blocking devices" on electronic distribution equipment that are

1 susceptible to hacking by a cybercriminal on our distribution assets in the
2 field.

3 **Q. HOW DO YOU EVALUATE COMPLIANCE-DRIVEN PROGRAMS?**

4 A. When evaluating compliance-driven programs as part of the Grid
5 Improvement Plan, we first focus on work that has a prescriptive mandate that
6 dictates how, when, or where the work must be done. For example, if a
7 federal regulation states that we must take certain activity on a certain set of
8 grid assets at a certain time, we necessarily put that work into our plan first
9 given that the Company has little discretion to do otherwise. Once that work
10 is incorporated into the plan, the Company then focuses on non-prescriptive
11 work that poses the highest risk to the grid and then continues to incorporate
12 grid protection work into the plan on a risk-advised basis, taking plan
13 constraints into consideration. Since this grid protection work must be done,
14 the Company does not evaluate these compliance-based programs with cost-
15 benefit analyses, but instead takes measures to ensure that this work is done in
16 a cost-effective manner. In Exhibit 6 to my testimony, I have included a
17 “gating tool” that the Company uses to determine how to properly evaluate the
18 costs and benefits of all the work in the Grid Improvement Plan. Compliance
19 Driven Programs include the following types of work and activities: electronic
20 access blocking and gating restrictions on computerized systems and
21 equipment; cyber defense computer programs and applications; physical
22 access restrictions and protective devices to substations and critical
23 equipment; and electromagnetic pulse protections on certain critical assets.

1 **Q. WHAT CONSTITUTES A RAPID TECHNOLOGY ADVANCEMENT**
2 **PROGRAM THAT YOU DESCRIBED AS THE SECOND “BUCKET”**
3 **OF WORK IN THE GRID IMPROVEMENT PLAN?**

4 A. Rapid technology advancement work that is needed to modernize the grid
5 consists of equipment, software, hardware, operating systems, and/or accepted
6 system operating practice that has advanced at an atypical pace causing the
7 need for rapid and sometimes frequent changes within the utility at a system
8 deployment level. Work in this category is usually related to system
9 communication, automation, and intelligence and must be executed at a
10 deliberate pace while ensuring not to deploy new technology before it has
11 reached maturity. While not technically compliance activities, work in this
12 category is essential for modern system operations. The State Energy Plan
13 anticipated the need for “communications among grid equipment and with
14 centralized systems” to address the challenges of rapid advancement in
15 technology and grid needs.³ Rapid Technology Advancement Programs
16 include the following types of work and activities: deploying new system-
17 wide communications devices so that the transmission and distribution system
18 can communicate back to us and with each other, replacing pneumatic and
19 manually actuating equipment with modern electronic and intelligent
20 equipment that is self-actuating and self-correcting, and installing advanced
21 system intelligence devices that will allow our underground and overhead

³ 2016 South Carolina State Energy Plan, Appendices, Page 121.

1 assets to proactively report their condition status and potential problems
2 before they manifest into equipment failures.

3 **Q. HOW DO YOU EVALUATE RAPID TECHNOLOGY ADVANCEMENT**
4 **PROGRAMS?**

5 A. In this area of the Grid Improvement Plan, the Company looks for
6 “enterprise” or system-level programs that enable interoperability and
7 functionality to grid operations and thereby impact and provide value to all of
8 our customers. A smart-thinking grid that can communicate and provide
9 information to us and our customers and that can automatically react to grid
10 events is essential to meet the demands of our customers and the implications
11 of the Megatrends in South Carolina. Programs that can help the Company
12 meet these requirements are selected for inclusion in this part of the Grid
13 Improvement Plan. Since these programs are essential to enable a modern-
14 functioning grid, the Company ensures that they are deployed and selected in
15 a cost-effective manner.

16 **Q. WHAT CONSTITUTES A SYSTEM OPTIMIZATION PROGRAM**
17 **THAT IS PART OF THE FINAL CATEGORY OF WORK IN THE**
18 **GRID IMPROVEMENT PLAN?**

19 A. Programs and projects in this category provide customers more benefits than
20 costs and solve for one or more of the external Megatrends that can have
21 negative impacts to customers and grid operations. Work in this category
22 spans a wide range of assets but primarily includes a “bundled combination”
23 of Integrated Volt/Var Control (“IVVC”), Self-Optimizing Grid deployments,

1 and advanced power electronic systems that, when working together, provide
2 optimum system performance for our customers. The Self-Optimizing Grid,
3 also known as the smart-thinking grid, redesigns key portions of the
4 distribution system and transforms it into a dynamic self-healing network that
5 ensures any issue on the grid can be isolated and customer impacts are limited
6 to hundreds versus thousands. These grid capabilities are enabled by
7 installing automated switching devices to divide circuits into switchable
8 segments that will serve to isolate faults and automatically reroute power
9 around trouble areas which call for expanding line and substation capacity to
10 allow for two-way power flow and creating tie points between circuits. The
11 IVVC program leverages the grid improvements from the self-optimized grid
12 and adds remotely-operated substation and distribution line devices such as
13 regulator and capacitor controllable field devices that enable a grid operator to
14 lower voltage as a way to reduce peak demand, thereby reducing the need to
15 generate or purchase additional power at peak prices (peak shaving) or to
16 operate in a conservation mode during periods of more typical electricity
17 demand in order to reduce overall energy consumption and system losses.

18 **Q. HOW DO YOU EVALUATE SYSTEM OPTIMIZATION PROGRAMS?**

19 A. In selecting these programs for inclusion in the Grid Improvement Plan, the
20 Company looks for programs that address the largest number of Megatrend
21 implications at the lowest costs to customers. System optimization programs
22 are justified by a qualitative and quantitative cost benefit analysis, and Exhibit
23 6 that I previously discussed provides more detail on how this is done at

1 various stages of program implementation. When a system-level program like
2 IVVC⁴ or Self-Optimizing Grid⁵ is deployed throughout our service territory
3 in South Carolina, the Company utilizes a program-level cost benefit analysis,
4 and examples of this type of analysis are included in Exhibit 7 to my
5 testimony. The Company also has a methodology for project-level cost
6 benefit analysis which examines the costs and benefits of deploying a specific
7 project solution based on the nature of a specific site. For example, the
8 Targeted Undergrounding⁶ and battery storage/micro-grid programs in the
9 Grid Improvement Plan are evaluated on a site-by-site basis using project
10 level cost benefit analyses. Examples of these sorts of analyses are also
11 included in Exhibit 8.

12 **Q. HOW HAS THE COMPANY SHAPED THIS COLLECTION OF**
13 **PROGRAMS INTO A HOLISTIC GRID IMPROVEMENT PLAN?**

14 A. Once the Company had selected the programs and projects that could meet
15 customers' needs in the manner that I have previously discussed, the Company
16 then had to develop a formal, year-over-year work plan that can be achieved
17 given the resource constraints that I discussed earlier in my testimony.

18 Further, the final Grid Improvement Plan had to be developed not only in a

⁴ IVCC is particularly notable because it provides multiple benefits and savings to all our various customer classes while at the same time allowing the Company to have maximum flexibility to react to multiple system conditions on the grid.

⁵ Self-Optimizing Grid is an example of investments with multiple layers of benefits as it helps customers save money in avoided system costs; allows more distributed energy resources (such as solar) to be on the grid; and provides containment and mitigation of outages by reducing thousands of impacted customers in an outage down to hundreds or less.

⁶ Target Undergrounding is the process of burying certain lines for cost saving and reliability purposes, and not for aesthetic purposes, and could yield savings for all of our customers over what they would otherwise pay to maintain and repair and overhead system in addition to the improved reliability that it will provide.

1 risk-advised manner, but in a manner that is fair to all of our customers. For
2 example, a Grid Improvement Plan that was too heavily weighted to address
3 only one of the Megatrends impacting South Carolina could be viewed as
4 short-sighted, while a Grid Improvement Plan that was too “diluted” and
5 lacked strategic focus would be ineffective. Similarly, a Grid Improvement
6 Plan that focused too heavily on one type or class of customer could be
7 viewed as unfair. The Company had to balance all of these and other
8 considerations when forming the final Grid Improvement Plan work.

9 **Q. HOW DID DUKE ENERGY BALANCE DIVERSE CUSTOMER AND**
10 **STAKEHOLDER NEEDS?**

11 A. The Grid Improvement Plan for South Carolina is designed with programs
12 that benefit all our customers, and that is one of the primary ways that we
13 have balanced our customers’ needs and interests. Over our three-year plan,
14 we have also balanced the pace, scope, location, and timing of our work to
15 ensure that customer and stakeholder needs are met. Further, we have kept the
16 needs of our rural and low-income customers in mind as we developed our
17 plan, and programs such as IVVC provide these customers both increases to
18 reliability and resiliency while at the same time providing decreases in fuel
19 costs, future capacity and carbon costs, and lower monthly energy usage.

20 **Q. WHAT IS YOUR RESULTING GRID IMPROVEMENT PLAN FOR**
21 **SOUTH CAROLINA?**

22 A. After completing all the steps in our plan development process, we arrived at
23 our Grid Improvement Plan, which is presented in Exhibit 9.

1 **Q. HAVE YOU SHARED THE DETAILS OF THIS PLAN WITH**
2 **INTERESTED STAKEHOLDERS IN SOUTH CAROLINA?**

3 A. Yes. On August 14, 2018, the Company conducted a South Carolina
4 stakeholder engagement workshop in Columbia that was led by a third-party
5 facilitator, the Rocky Mountain Institute (“RMI”). During that workshop, the
6 Company received input from multiple South Carolina stakeholders on grid
7 improvement issues that are important to them. At the conclusion of that
8 workshop, RMI prepared a detailed, post-workshop report reflecting the issues
9 and questions raised by our customers and stakeholders, and I have included
10 that report as Exhibit 10 to my testimony.

11 With the information and feedback that we received from that August
12 14, 2018 workshop, the Company then spent the next several weeks
13 incorporating stakeholder input into the development of the proposed Grid
14 Improvement Plan for South Carolina. On October 5, 2018, the Company
15 sent a detailed “pre-read package” to South Carolina stakeholders describing
16 the development and final proposed Grid Improvement Plan in advance of the
17 next South Carolina stakeholder workshop. I have included that pre-read
18 package as Exhibit 11.

19 On October 10, 2018, the Company held its second South Carolina
20 stakeholder workshop in Columbia that was also facilitated by RMI. During
21 that workshop, South Carolina customers and stakeholders were able to
22 provide the Company detailed feedback on the proposed Grid Improvement
23 Plan that the Company had provided as a pre-read in advance of the

1 workshop, and the Company took note of several constructive comments and
2 suggestions from workshop attendees. RMI similarly prepared a post-
3 workshop report of that stakeholder meeting, and I have included it in my
4 testimony as Exhibit 12.

5 **Q. IN SUMMARY, WHAT CONCLUSIONS HAVE YOU DRAWN BASED**
6 **ON ALL THE STEPS YOU TOOK TO DEVELOP THE GRID**
7 **IMPROVEMENT PLAN?**

8 A. I am confident that the South Carolina Grid Improvement Plan is well
9 thought, properly balanced, and fairly developed by listening to and
10 incorporating input from our South Carolina customers and stakeholders. I
11 am also confident that the South Carolina plan is a reasonable and prudent
12 choice for all our customers in South Carolina, and that fact is evidenced by
13 the objective and clear benefits that it will provide.

14 **Q. WHAT GRID IMPROVEMENT WORK HAS THE COMPANY DONE**
15 **IN 2018 TO SUPPORT THE SOUTH CAROLINA GRID**
16 **IMPROVEMENT PLAN?**

17 A. In 2018, the Company has initiated and completed several foundational
18 projects for the Grid Improvement Plan. Under the Self-Optimizing Grid
19 program, the Company has installed reclosers that will form five optimized
20 self-healing networks in 2018 in Greenville, Spartanburg, Simpsonville and
21 Lancaster counties. Targeted Undergrounding activity was concentrated on
22 undergrounding 2.5 miles of overhead lines. The 2018 work also included
23 projects to provide back-feed connectivity and capacity for rural communities

1 and business districts that experience long duration outages and to improve
2 sectionalization on distribution circuits to reduce the number of impacted
3 customers during system events, including a high impact site project focusing
4 on the Spartanburg Medical Center. Transmission work in 2018 included
5 projects in Cedar Creek Hydro, Woodruff, North Street, and Clinton Tie
6 substations where oil breakers have been replaced with gas breakers. The
7 Company also initiated system intelligence projects which include installing
8 new microprocessor relays at the Newport Tie, Catawba Nuclear and Corona
9 Tie stations along with physical and cyber security work in the
10 Upstate. Also, the Company initiated “core” router and “edge” substation
11 router communications replacements, and work continued for the replacement
12 of 2G/3G cellular modems for distribution line devices with 4G and 5G
13 modems, fiber optic cable, microwave, optical systems and system radio
14 networks. Finally, enterprise system work included upgrades for “SCADA”
15 and “DMS” system communications systems which are working toward
16 delivery of new platforms by the end of 2019. All of these projects in 2018
17 are reasonable and prudent foundations of the South Carolina Grid
18 Improvement Plan.

19 **IV. RATE RECOVERY OF THE MAINTAIN BASE AND GRID**
20 **IMPROVEMENT INVESTMENTS**

21 **Q. HAS THE COMPANY SOUGHT ANY ADDITIONAL RECOVERY**
22 **METHODS FOR ONGOING COST FOR GRID IMPROVEMENTS?**

23 **A.** Yes. The Company’s application requests that the Commission approve our
24 Grid Improvement Plan along with associated Phase 1 and Phase 2 rates.

1 Witnesses Smith, Pirro, and Hager explain the details of the Company's
2 proposal for the recovery of Grid Improvement Plan costs.

3 **Q. ARE YOU SPONSORING THE GRID IMPROVEMENT PLAN**
4 **REFERENCED ABOVE?**

5 A. Yes. I have provided work plans for Commission approval in Exhibit 9 and I
6 have provided the associated system level cost, both capital spend and
7 operating and maintenance expense, to witness Smith for use in the
8 development of the Phase 1 and Phase 2 rates being requested.

9 **Q. IF THE COMMISSION APPROVES THE PHASE 1 AND PHASE 2**
10 **REQUESTED RATE CHANGES FOR GRID INVESTMENTS,**
11 **BASED ON THE PLANS SUBMITTED IN THIS CASE, WOULD THE**
12 **PARTIES HAVE A CHANCE TO REVIEW THE WORK COMPLETED**
13 **IN ADVANCE OF THE EFFECTIVE DATE OF NEW RATES?**

14 A. Yes. The Company is willing to file quarterly status reports to apprise
15 stakeholders of the progress made on the Grid Improvement Plan and our
16 expenditures. The Company also commits to a 60-day audit, during which
17 time the ORS and interested parties could review the costs we have incurred
18 relative to the Grid Improvement Plan ultimately approved in this case in a
19 manner that is acceptable to ORS. We would file that information for the
20 prior year for auditing purposes by March 1, 2020 and March 1, 2021, as
21 explained in further detail by Witness Smith.

1 **Q. IF APPROVED, WOULD THE COMPANY AGREE TO PUT FORTH**
2 **THE SAME INFORMATION FOR FUTURE YEARS?**

3 A. Yes. The Company envisions that the expenditures not established in this
4 case would be brought back before the Commission through a process like this
5 one for similar treatment.

6 **Q. DO YOU INTEND, THROUGH THIS PROCESS, TO CONTINUE THE**
7 **SC GRID IMPROVEMENT WORKSHOPS AND ENGAGE WITH**
8 **PARTICIPATING STAKEHOLDERS THROUGH THE NEXT**
9 **SEVERAL YEARS?**

10 A. Yes. Our grid improvement needs and planning process span multiple years,
11 and we expect to have continuing dialogue with interested parties on those
12 plans and how it benefits and affects those interested parties and to continue to
13 bring those findings to the Commission in the form of future requests.

14 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

15 A. Yes.